



Tobii Technology

Gaze Interaction in Assistive Technology and Healthcare

Kaveh Vefagh – Tobii Assistive Technology

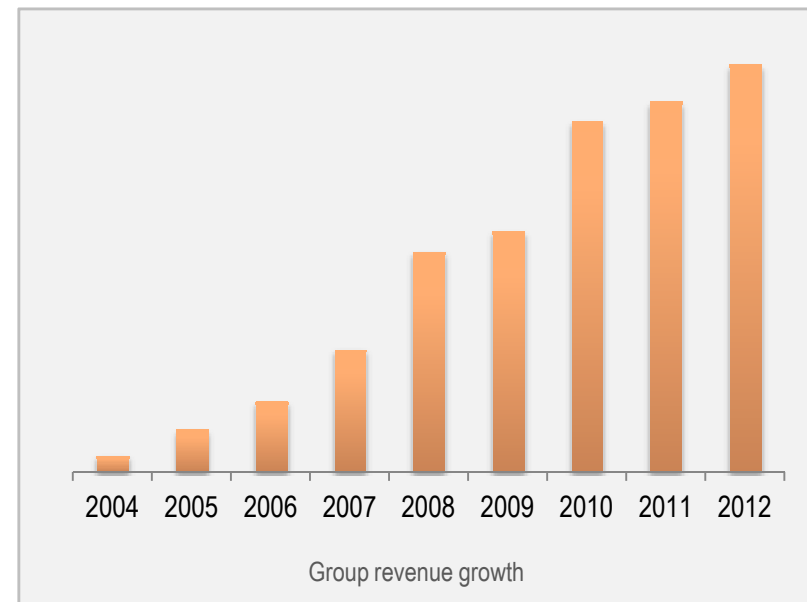
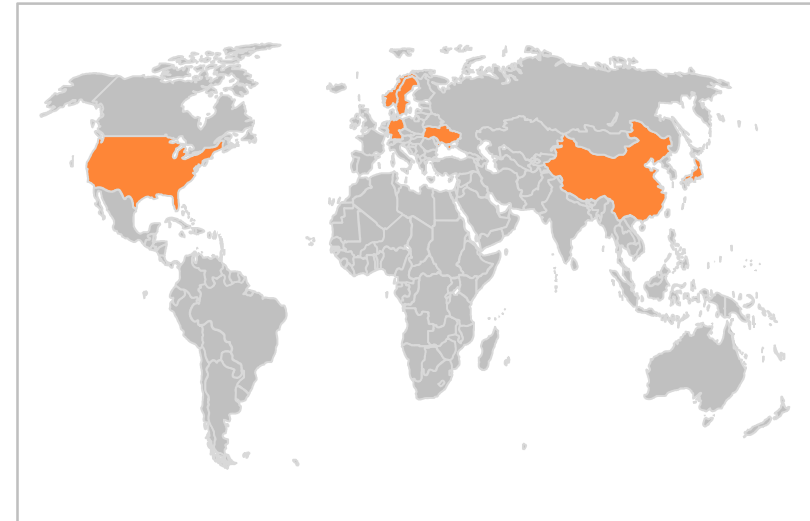
World Usability Day – Sophia Antipolis

Agenda

- Tobii Corporate Profile
- Tobii BUs and Technology
- Assistive Technology
 - Hardware
 - Software Interfaces
- Eye control in Healthcare
- Testing of devices

Tobii Technology in brief

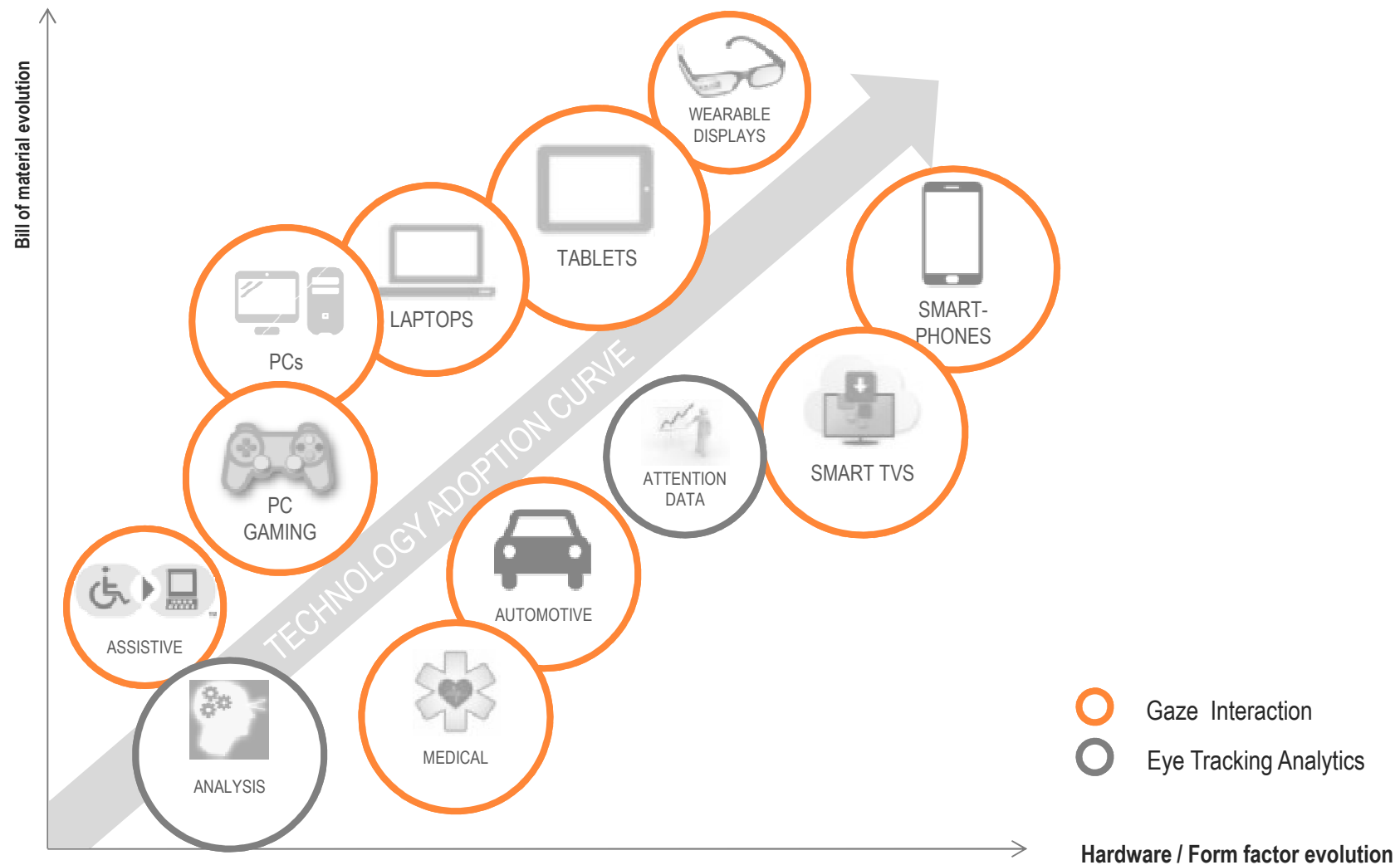
- Founded in 2001
- Global market & technology leader of eye tracking
- 400 employees worldwide, whereof 150 in R&D
- HQ in Sweden, Offices in US, Japan, China, Germany, Norway, and Ukraine



A decade of eye tracking & business innovations



Technology evolution and markets

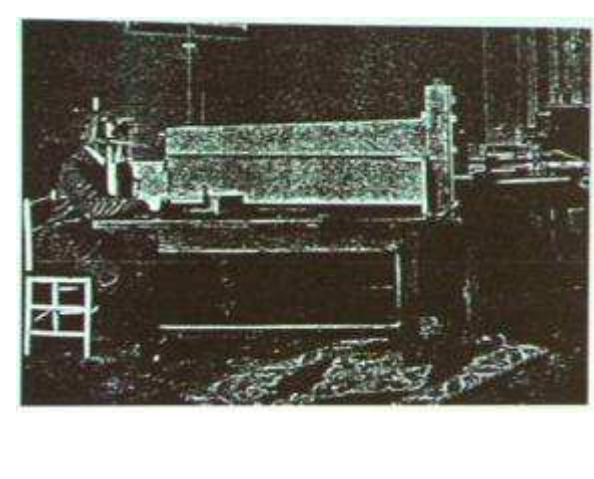
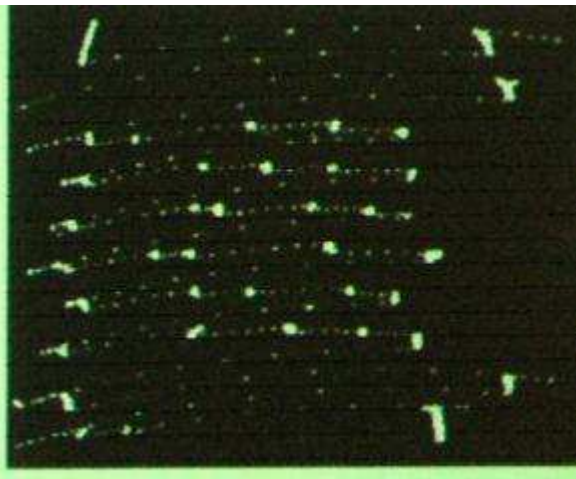
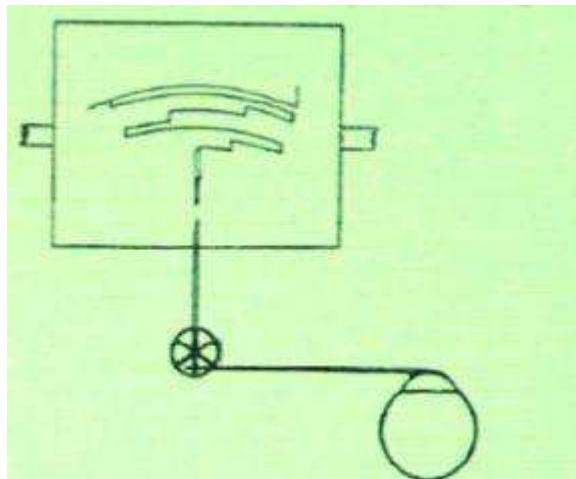




Eye tracking

AN AMAZING TECHNOLOGY

Eye tracking is not a new invention!

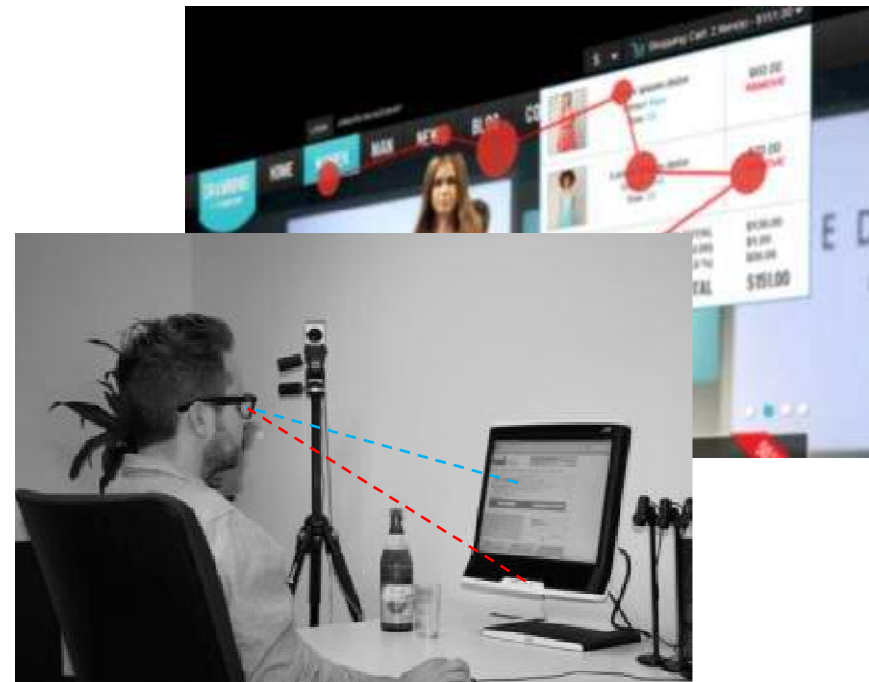


The two sides of the coin

- Eye tracking is a technology that makes it possible for computers to know exactly where users are looking.
 - interact with a computer
 - study what a person is looking at



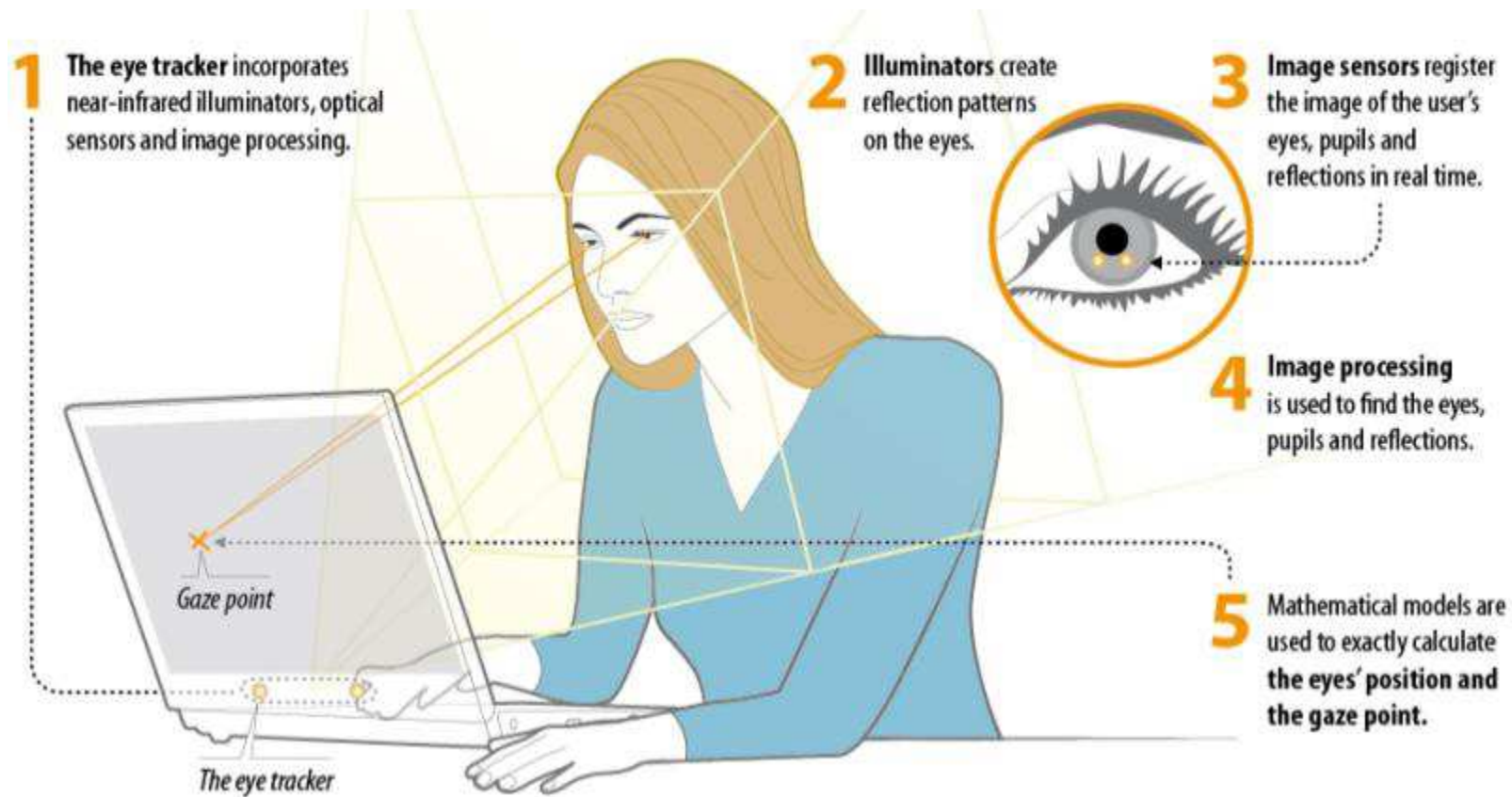
Eye control in communication and computer interaction



Eye tracking in web usability testing

Eye tracking step by step

An eye tracker is a device that uses illuminations and optical sensors to gather data about gaze direction or eye movements with very high accuracy.

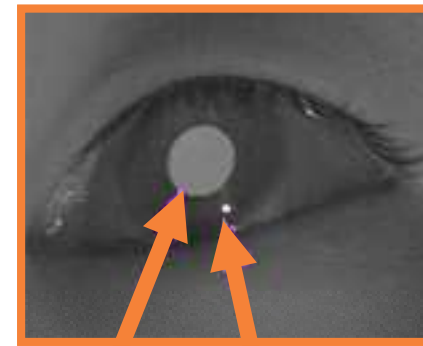
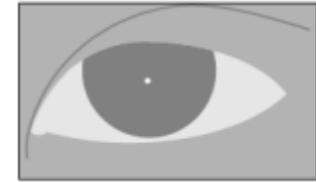


The Bright Pupil Effect

Caucasian

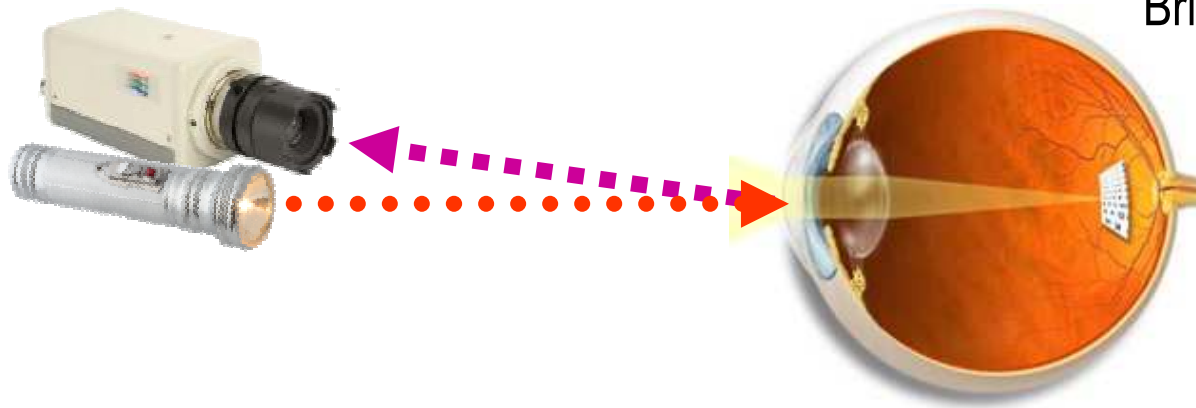


Asian



Bright Pupil

Reflection (Glint)

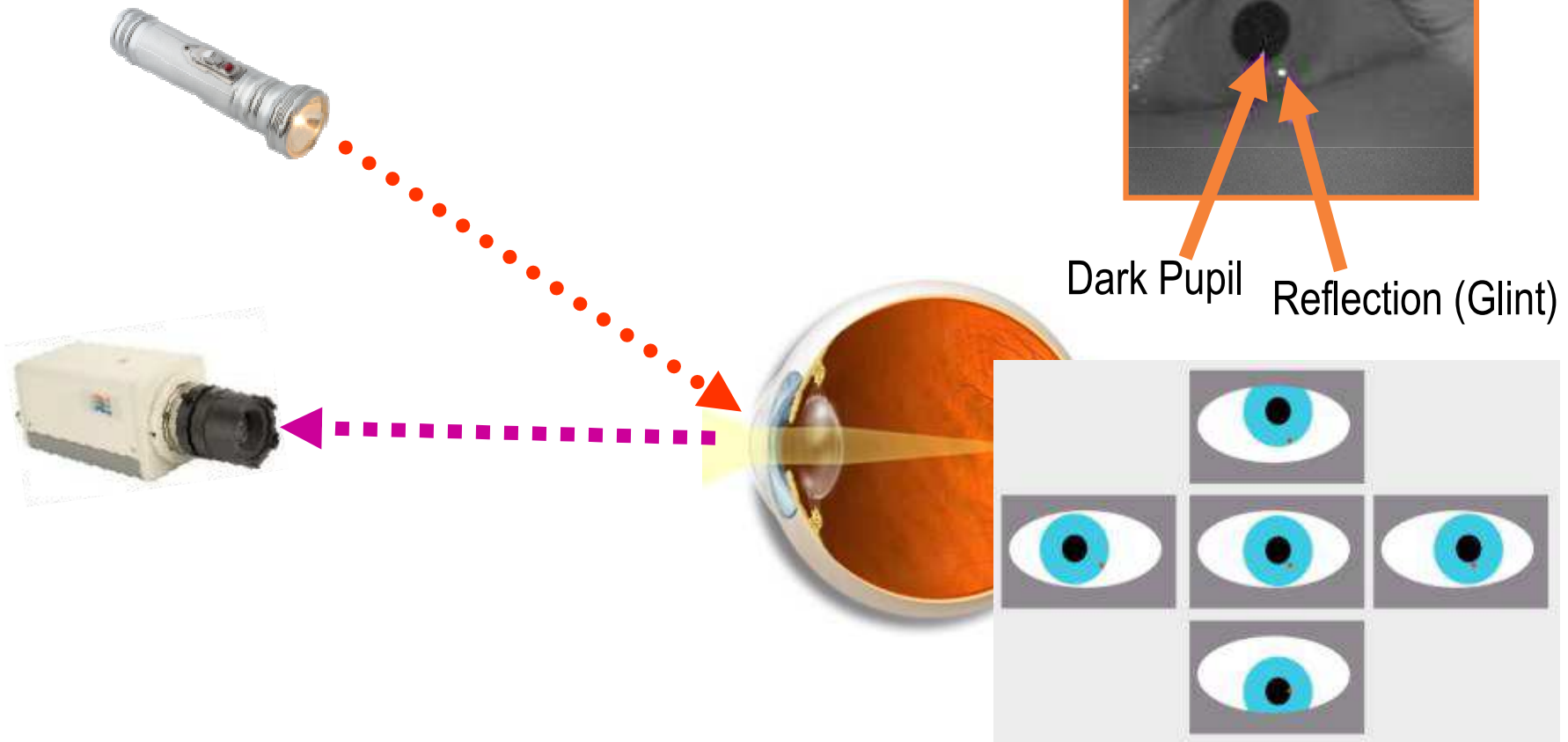
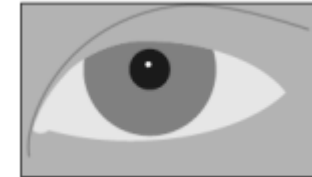


The Dark Pupil Effect

Caucasian



Asian



Three business units with leading solutions and dominant market share



OEM Solutions

Creates eye-tracking solutions and gaze interaction experiences for consumer electronics and niche markets



Analysis Solutions

Offers eye tracking solutions and services for market research, user experience testing and scientific research



Assistive Technology

Offers comprehensive communication solutions that meets the individual needs of people with speech impairments



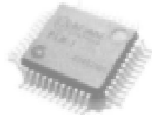
Eye tracking integration and gaze interaction in consumer electronics and niche applications

OEM SOLUTIONS

Tobii's vision and mission for OEM Solutions



Tobii's vision is to redefine human-computer interaction with gaze interaction



Tobii's mission is to become the leading supplier of proprietary component technology, core algorithms, middleware and system designs for eye tracking and gaze interaction



Tobii aims to be the leader in all major volume segments for eye tracking, including computers, mobile devices, cars, wearable displays, gaming and high-value verticals

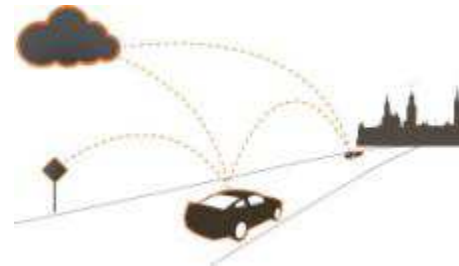
Eye tracking in every computer will create mind-blowing user experiences

- **Tobii Gaze™** is transforming the way we use computers to communicate, play and work. It creates an easy and intuitive interface that uses your natural eye movements.
- **A super-effective position modality** – The combination of the eye gaze for pointing and other modalities for issuing commands is intuitive and extremely powerful.
- **Adaptive user interfaces** – the computer can automatically and invisibly detect the user's attention. It can respond much more effectively and intuitively to serve the user in a magical way.



Advanced Driver Assistance with Tobii Eye Tracking

- Connected cars require intuitive and non-distracting interfaces
 - Eye tracking provides the most natural and intuitive look-and-click interface today.
 - It will help auto companies to design connected-vehicle features and infotainment systems that reduce driver distraction during use.
- Driver status monitoring prevents accidents due to drowsiness
 - The very same eye tracking system can also monitor a driver's status, as well as warn one who's drowsy or distracted to help prevent accidents.



Eye tracking integration and business development

- Tobii IS-20 and Tobii IS30 integration systems
 - designed for mass market applications
 - autonomous embedded eye tracking
 - used in several eye tracking products
- Components and system designs for consumer electronics
- Concept integrations with partners such as
 - Lenovo
 - Synaptics
 - NTT Docomo

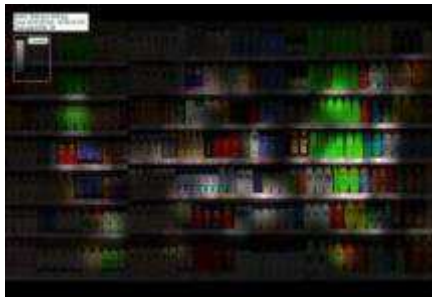




Eye tracking solutions for research

TOBII ANALYSIS SOLUTIONS

Analysis Solutions - markets and applications



Market research

- Print ads
- TV commercials
- Web advertising
- Package design
- Shelf placement
- Shopper research



User experience testing

- Websites
- Software
- Computer games
- Mobile devices
- Other physical products



Psychology & vision research

- Cognitive psychology
- Developmental psychology
- Psycholinguistics
- Media psychology & HCI
- Neuroscience
- Nonhuman primate research
- Ophthalmology

Complete eye tracking solutions

Hardware eye tracking systems



Eye tracking software solutions



Training and consultancy services



Hardware eye tracking systems

- Integrated eye tracking systems for any on-screen study
- Head mounted eye tracking systems for mobile studies
- Modular eye tracking systems with flexible configurations



KLM Royal Dutch Airlines – user experience testing in the redesign of their electronic booking tool

Departure Wednesday 11 August 2010

Price	Departure	Arrival	Travel time	Operator	Flight number
€109.99	17:10 Amsterdam	18:00 Stockholm	1:50	KLM	621
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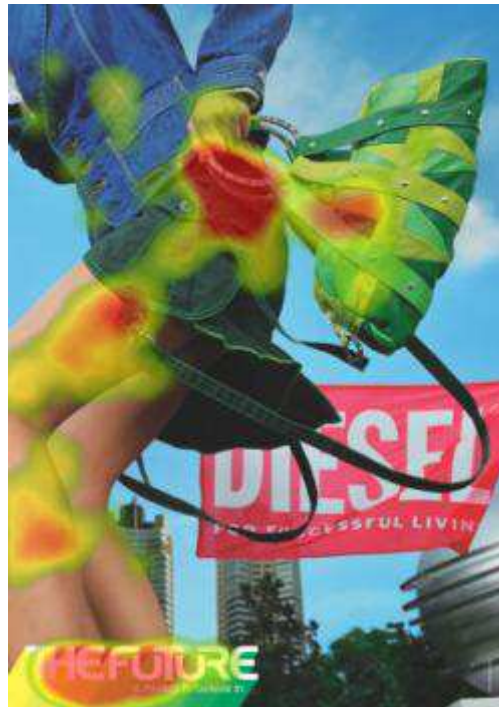


- Using a Tobii T120 to test functional prototype of re-designed electronic booking tool, Retrospective Think Aloud (RTA)
- Many findings, eye tracking highlighting problems otherwise undetected
- Saccades between price and schedule, eye tracking illustrated the inefficiency
- Online reservations increased dramatically after eye tracking tests. 30% more users proceeded from searching to actually booking flights in the new version.

“Analysis of eye tracking data proves valuable in finding very specific and detailed design issues, which would very likely have gone unnoticed in a study without the support of eye tracking. These issues, albeit small, can make the difference between a sale or a disappointed customer.”

Joris Leker, Usability Specialist, Valsplat

Communication & Online Marketing



No-one sees
the brand



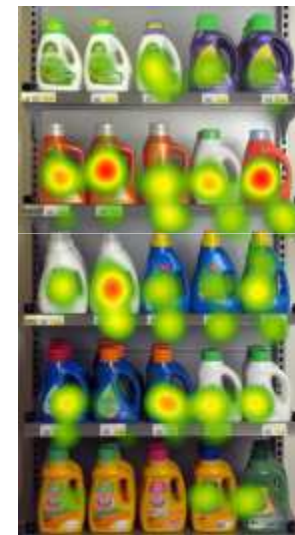
Brand & Communication

- Eye tracking is well established for pre-testing and analyzing print, TV & online ads
- Measure exactly where people look
- This Heat map based on data aggregated from multiple participants looking at a print ad clearly shows why the perfect image might just be too perfect.

Online Marketing

- It's time to stop guessing and to start knowing what surfers and e-shoppers want.
- In this case, all boxes on the right & the left side of the page are practically ignored.
- "Cheap buys" is the strongest headline in banners. The big and valuable central area around that receives little attention.

Tobii Glasses – Retail & Shopping, Sports & Media Research



- Optimize your store and shelf space layout
 - Let a test group use Tobii Glasses and you will know exactly what products your shoppers are looking at and which they miss
- Other use cases
 - Sports-, and media-research, usability testing and other research areas

Guerrilla Games – user experience testing on video game “Killzone 3”



- Tobii T60 XL tracking six participants during eight-hour game playing sessions
- Fine tuning at a later stage of development as a part of a larger user experience development process.
- Developers realized the full potential of eye tracking analysis, especially when applied early in the development process
- Proved highly relevant for improving Path Finding, Theatre of War, menu navigation, Heads Up Display and visual storytelling

Primate Research Institute for Kyoto University – Studies on human and chimpanzee face scanning



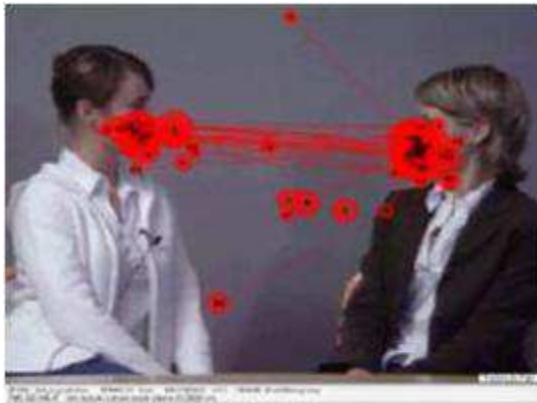
- Tobii X120 with 72 color photos were shown to six chimpanzees and 18 humans
- Analyzed using an application created using Tobii Software Development Kit
- Providing great insights on the differences in face perception between humans and chimpanzees
- Face is central in both groups, with a focus on the mouth instead off the eyes for the chimpanzees participants

Ipsos & MRC International for Carlsberg – on-trade POS promotion unveiled

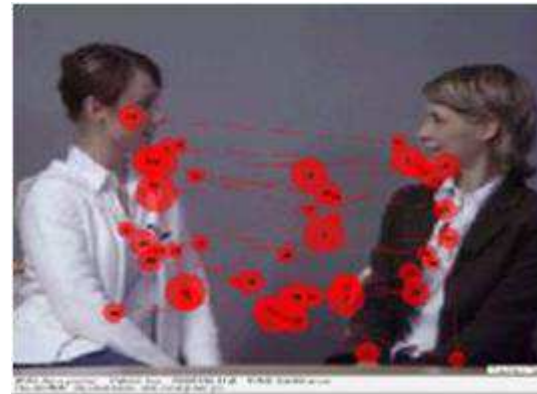


- 250 respondents using Tobii Glasses in 2 bars and 1 restaurant
- Interviews with respondents and bar tenders
- High correlation between visible promotion and order-choice, customer can be influenced at point of sale
- Carlsberg can pin-point their on-trade promotion, improving budget efficiency

Developmental Psychology Research with Tobii Eye Trackers – Autism Prediction



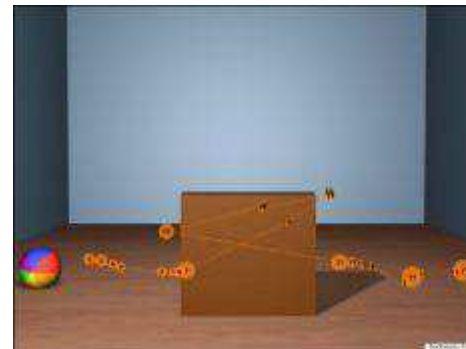
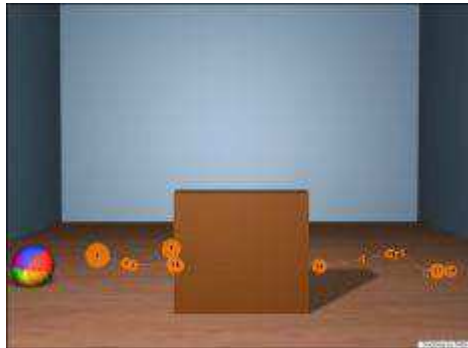
Autism prediction: A normal child's perception of social interaction.



Autism prediction: An Autistic child's perception of social interaction.

- Autism is characterized by pervasive impairments in several important areas of development such as
 - Reciprocal social interaction and communication
 - Behavior
 - Imagination
- The pictures show a normal and an autistic child's perception of a social interaction
- Early detection increases the chance that children with autism and their families gets adequate help support
- Late diagnosis hinders good projection & treatment

The Baby Lab at the Department of Psychology at Uppsala University

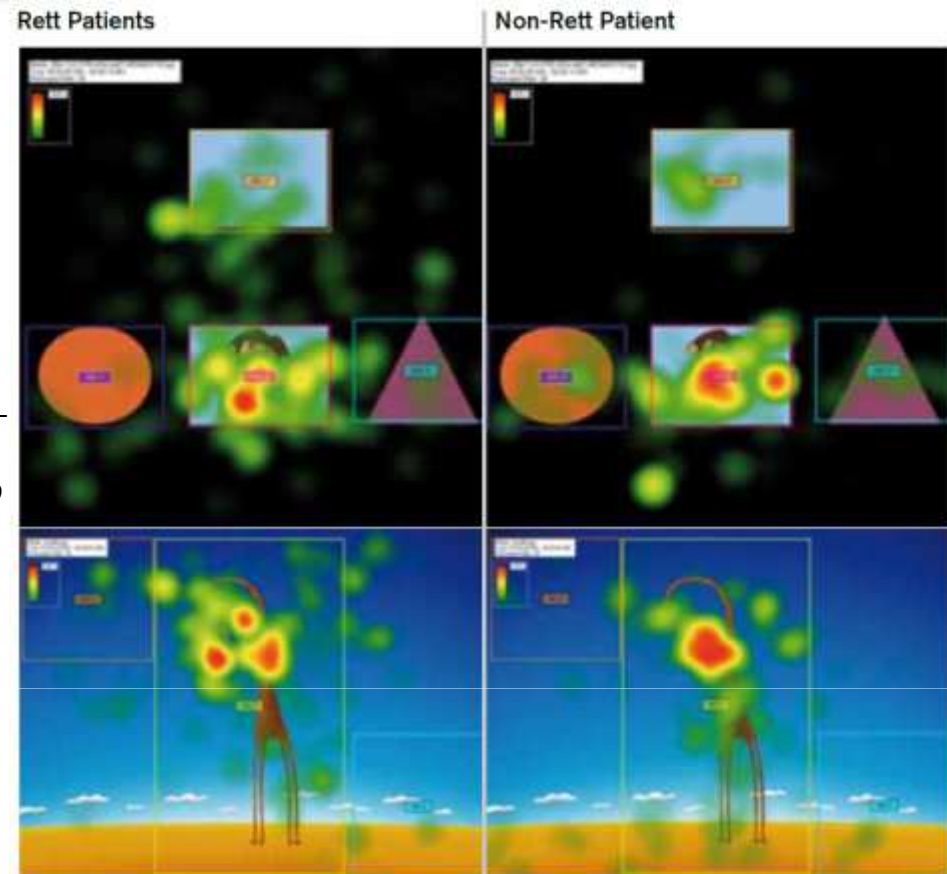


- Study on infants ability to represent temporarily occluded objects

Rett Syndrome

“Eye gaze technology allowed us to give Rett Syndrome patients a voice – way to communicate their perception of what they see. This is of immeasurable value because most of these patients have no other way to communicate their knowledge or understanding due to extreme physical disabilities.”

**Dr. Aleksandra Djukic, Rett Syndrome Center,
Children’s Hospital at Montefiore, Albert
Einstein College of Medicine.**



- Patterns of visual processing in Rett Syndrome patients and non-Rett control subjects were compared
- Rett Syndrome patients appeared to demonstrate similar fixation patterns compared to non-Rett individuals and meaningful visual searching strategies.

Tobii World Leader in Eye Tracking – Select Clients

COLUMBIA UNIVERSITY
DIGITAL KNOWLEDGE VENTURES

HARVARD UNIVERSITY

Princeton
University

Duke
UNIVERSITY

Yale University

Penn
UNIVERSITY

MICHIGAN

THE UNIVERSITY OF
TEXAS
AT AUSTIN

MIT
Massachusetts
Institute of
Technology

ORACLE®

THE UNIVERSITY OF
CHICAGO

YAHOO!

Google™

Microsoft®
amazon.com.



Johnson & Johnson

P&G

Unilever

kraft foods
make today delicious



ebay



Communication solutions for people with special needs

TOBII ASSISTIVE TECHNOLOGY

Why Are Our Users So Positive?

- Because eye gaze performance is so much greater than with legacy solutions

- Keyboard pins
- Trackball
- Mouth Stick
- HeadWand
- Joystick
- Facial movement
- Keyboards
- Headmouse
- Sip & Puff



The above is not 21st Century Computer Access

Assistive Technology – enabling people to communicate

- Our AAC (Alternative and Augmentative Communication) solutions enable people to
 - Speak
 - Interact
 - Control and access computers
 - Live independent and fulfilling lives – regardless of their disability.
- It's life changing for people with
 - CP, brain injuries, spinal injuries, stroke and autism, RETT syndrome, ALS...
- Thousands of users around the world rely on Tobii's solutions in their everyday communication.



Communication and access devices

- Tobii I-Series
 - dedicated communication devices

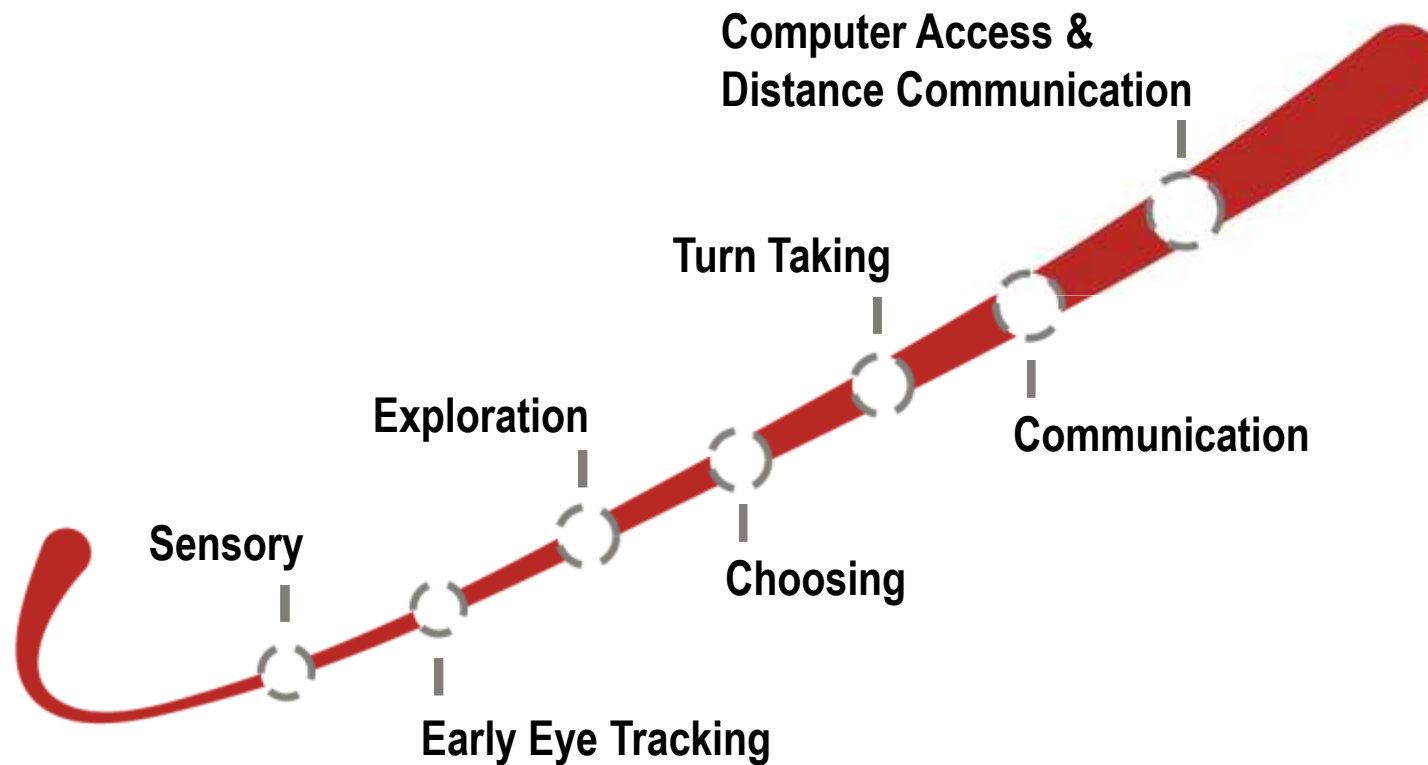


Eye controlled communication and access

- Tobii PCEye Go
 - stand-alone eye control unit with the ability to control laptops, PCs and tablets



The Tobii Eye Gaze Learning Curve



Software for Learning eye control

- EyeFX
- Look to Learn



Language and software content

- Tobii Communicator
 - a platform for personal solutions to develop communication
 - a basic language tool to optimize access to communication aids through individual skills.
- Sono Suite
 - a comprehensive research-based content package with vocabularies for different
 - skill-sets
 - development levels
 - communicative intentions.

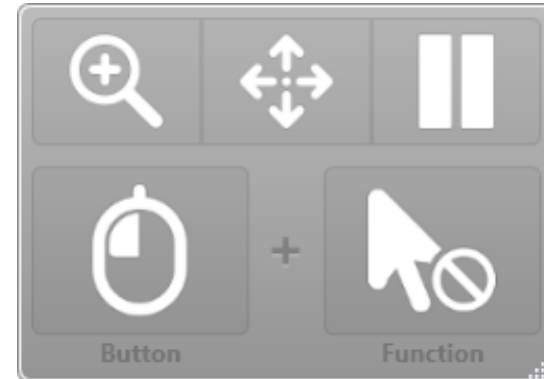


Interfaces for Communication



Computer Access

- Windows Control Methods
 - Mouse Emulation
 - Gaze Selection



Eye Gaze Will Gradually Improve Computer Access

- For less and less severe conditions

Technology Evolution				
	No voice	No hands	Restricted hand / shoulder use	Mainstream
Core need	Speech (AAC)	Computer Access	Computer Access	Computer Access
Hardware	SGD: I-series	PCEye Go	PCEye Go	Next gen
Software	Tobii Communicator	Gaze Interaction	Combined eye & hand control	Combined eye & hand control
Conditions	ALS/MND CP RETT	Spinal Cord Limb-loss Rheumatism Muscular Dystrophy Muscular Atrophy Traumatic Brain Injury	Musculoskeletal disorders: Mouse arm Carpal tunnel	"normal" user

The Words of Our Users – Stephen Murray



http://www.youtube.com/watch?v=b_wsnc8ldCQ

Sarah Ezekiel – ALS – Eye Gaze Artist

- **Sarah**
 - Everything was pretty straightforward for me until the age of 34. I was happily married with a beautiful little girl and pregnant with my much longed for second child. it happened that quickly and I was absolutely terrified. My world was shattered. My marriage collapsed as I became progressively disabled. I couldn't physically care for my children or myself anymore, and spiralled into deep depression.
 - I'm now using the Tobii PCEye . I've had articles published, given presentations to health professionals, made two films, participated in several photo shoots and had my portrait painted. I'm the London Jewish News Community Hero 2010, and the Sarah in the MNDA's advert 'Sarah's Story'. I'm also the Secretary of the NW London branch of the MNDA.
- **Sarah's story**
 - www.tobii.com/en/assistive-technology/global/user-stories/als/sarah-and-her-tobii-pceye/
- **Sarah's website**
 - www.sarahezekiel.com
- **Sarah's Eye Gaze art exhibition**
 - www.eyegazeartists.com
- **Youtube video**
 - www.youtube.com/watch?v=g-s2E0Yu0XE
 - http://www.youtube.com/watch?v=iySFHNo6c_M
- **Tobii & Sarah partners with Royal College of Art**



Kathrin Lemler – CP – University Graduate



- Kathrin studies educational science at University. In doing so, she became the **first non-verbal person to graduate from university in Germany**. For Kathrin, the Tobii C12 is the best solution for writing texts, doing research on the Internet or communicating.
- “Tobii gave me the opportunity for a more independent life,” says Kathrin. “I am able to talk to strangers even without the help of caregivers and am able to communicate indirectly, over distance, using a lot of functions like sms, chat and social networks like facebook.”
- <http://www.tobii.com/en/assistive-technology/global/user-stories/cerebral-palsy/kathrin-and-her-tobii-c12/>

Lasse – Muscular Atrophy

- **Lasse**

- *Lasse has had Muscular Atrophy since birth. He is currently working more effectively thanks to Tobii PCEye*

- **Citat**

- *“It changed my life. After all of these years using a mouth stick, I finally have an easier way of working on my computer. It is so fast”*
- *“I always wanted to be able to be more efficient and get more done at work...just never knew there was another way until now.”*

- **Lasse’s Story**

- www.tobii.com/en/assistive-technology/global/hidden-pages/rehab-sci/user-experiences/working-with-the-eyes/




Eye Gaze Artist - Francis Tsai

Eyegaze Artist



Art created with
Tobii eyegaze

Please visit:
<http://teamgt.com/>



Need for early communication in Hospital ICU and ER

Kaveh

Early Communication – Reasons for the need?

- Accidents => **Spinal cord Injury**
- Need for mechanical ventilation => **Tracheotomy** (Respiratory intubation)
- Brain trauma, stroke => **Aphasia**



Stroke

WARNING SIGNS

Stroke is a medical emergency. The American Stroke Association says you should know these warning signs because when it comes to a stroke, every second counts.

- Sudden numbness or weakness of the face, arm or leg, especially on one side of the body.
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, loss of balance or coordination
- Sudden, severe headache with no known cause



Descriptive reports of the mechanical ventilation experience in the ICU

- Patients experience:
 - **FEAR**
 - **PANIC**
 - **STRESS**
- As a result of the inability to speak

Early Communication Offers Significant Psychological & Physical Benefits

- A dramatic reduction in anxiety, fear, panic and stress levels.
- A dramatically improved ability for faster rehabilitation.
- Enriched quality of life during recovery.



Marcus: His arms and legs are completely paralyzed. He is not able to talk either, as no air can pass through his vocal cords. When he tries, nothing comes out. During his studies, **Marcus learned Morse code**, so he tries to communicate with the nurses standing at his bedside. **He blinks in short and long blinks**, however, the **nurses do not understand anything and ask him if he has something in his eye.**

Early Communication Offers Measurable Economic Values

- Cost effectiveness in ICU department
 - High cost for ICU bed with mechanical ventilation (day 1: \$11.000 => \$4.000/day over time *)
- Reduced care costs and less caregiver burn-out
 - More independence (caregiver burn out \$60-80k/year**)
- Lower medical costs
 - Improved overall emotional health
- Decreased recovery time
 - Improved early stage communication
- Anti-infection
 - Effective communication 100% touch free
- Leader in patient care

* Crit Care Med 2005

June ;33(6):1266-71

** Shepherd Center SCI
Model System

Early Communication – what can be used today?

- Patient with full hand movement capability:
 - Touch devices
 - Communication boards
 - Paper and pen
 - Gestures

- Tetraplegic patients:
 - Communication boards (Used by nurse)
 - Touch devices (Used by nurse)
 - Eye-gaze communication system

What were the most common barriers to device use?

- Device out-of-reach
- Upper extremity & neck wounds
- Blurred vision
- Insufficient staff training in use
- Time
- Patient preference for writing or other method











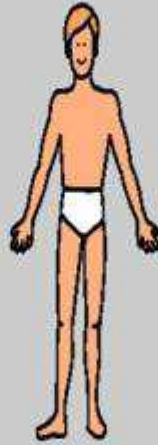














Basic Messages

- Pain
- Shortness of Breath
- Suction
- Help!
- Hot/Cold
- Home/Family
- Anxiety/Worry

Examples of communication boards used.



Examples of communication boards used.

	A	B	C	H	D	E	F	G	H	I	J	K	L	M	N	Ñ	O	P	Q	R	S	T	U	V	W	X	Y	Z
L o g o	si yes 		beber drink 		cuándo when 		dónde where 		doctor doctor 		enfermera nurse 		no no 		0													
	frío cold 		dolor pain 		picor itch 						2																	
	calor hot 		dolor de cabeza headache 		mareado dizzy 						3																	
	Fiebre temperature 		problemas de corazón heart problem 		ahogar choke 						4																	
	baño bathroom 		bacinilla bedpan 		botella urinal 						5																	
	compresa sanitary napkins 		pañal diaper 		cepillar los dientes brush teeth 		lavar wash 		6																			
	7		8		9																							

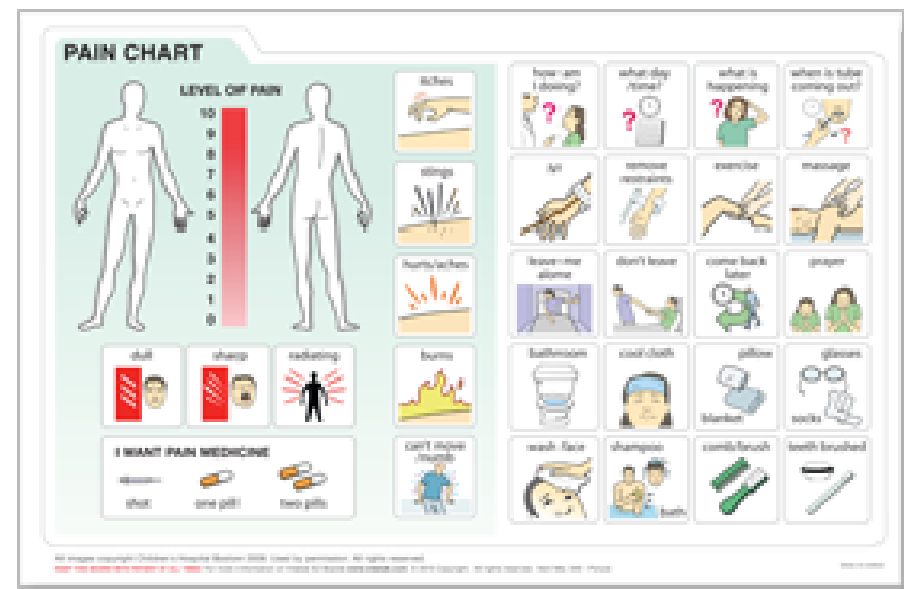
Simbolos Mayer Johnson copyright 1990 2005 Diseñado por CCA, teléfono +34687570693 Copyright 2006

Inicio Boardmaker with SDP... Dibujo - Paint ES 11:03

Examples of communication boards used.



Examples of communication boards used.



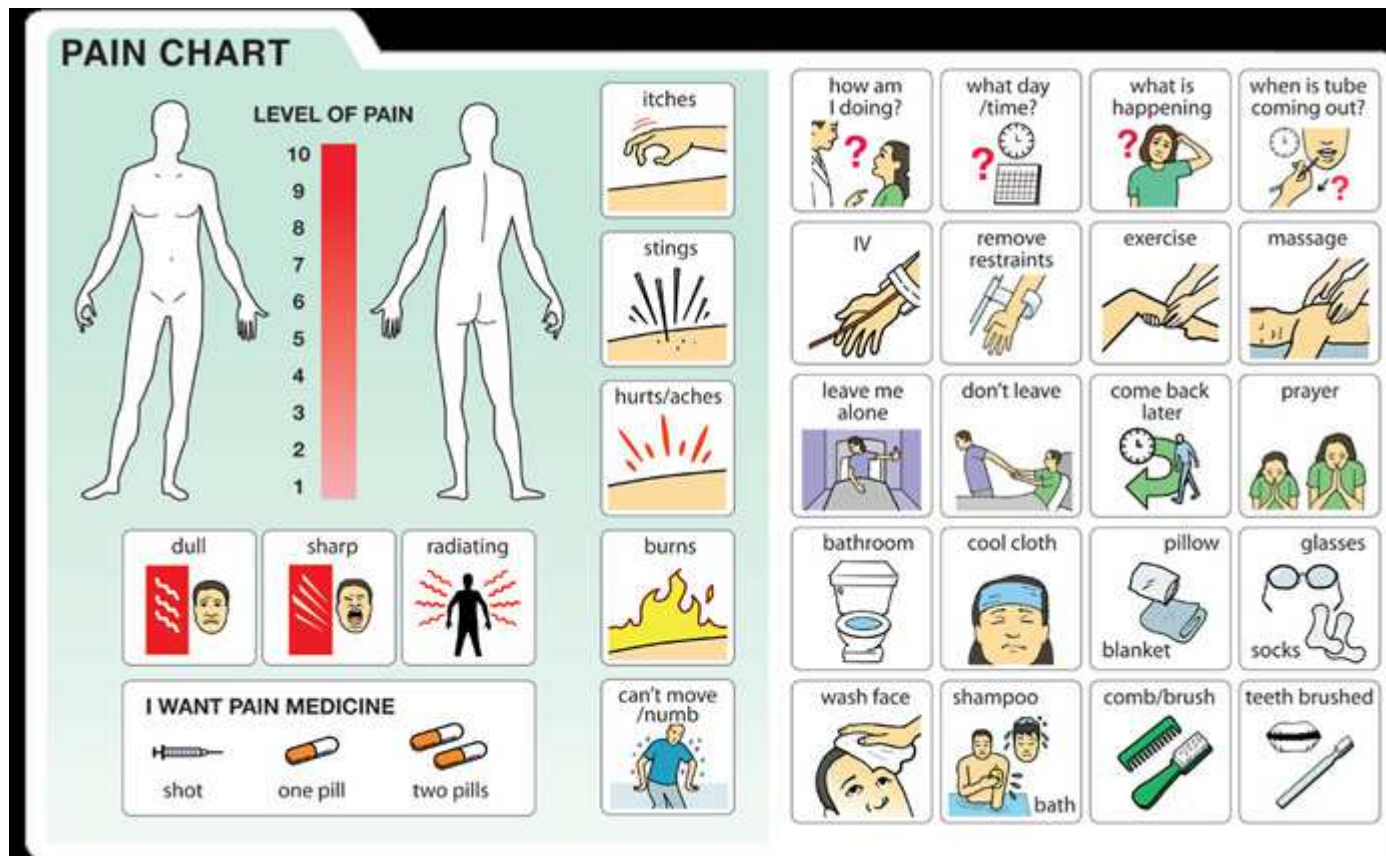
Examples of communication boards used.



Examples of communication boards used.



Examples of communication boards used.



Tobii I-Series



Tobii I-Series



I-Series directly placed on a table

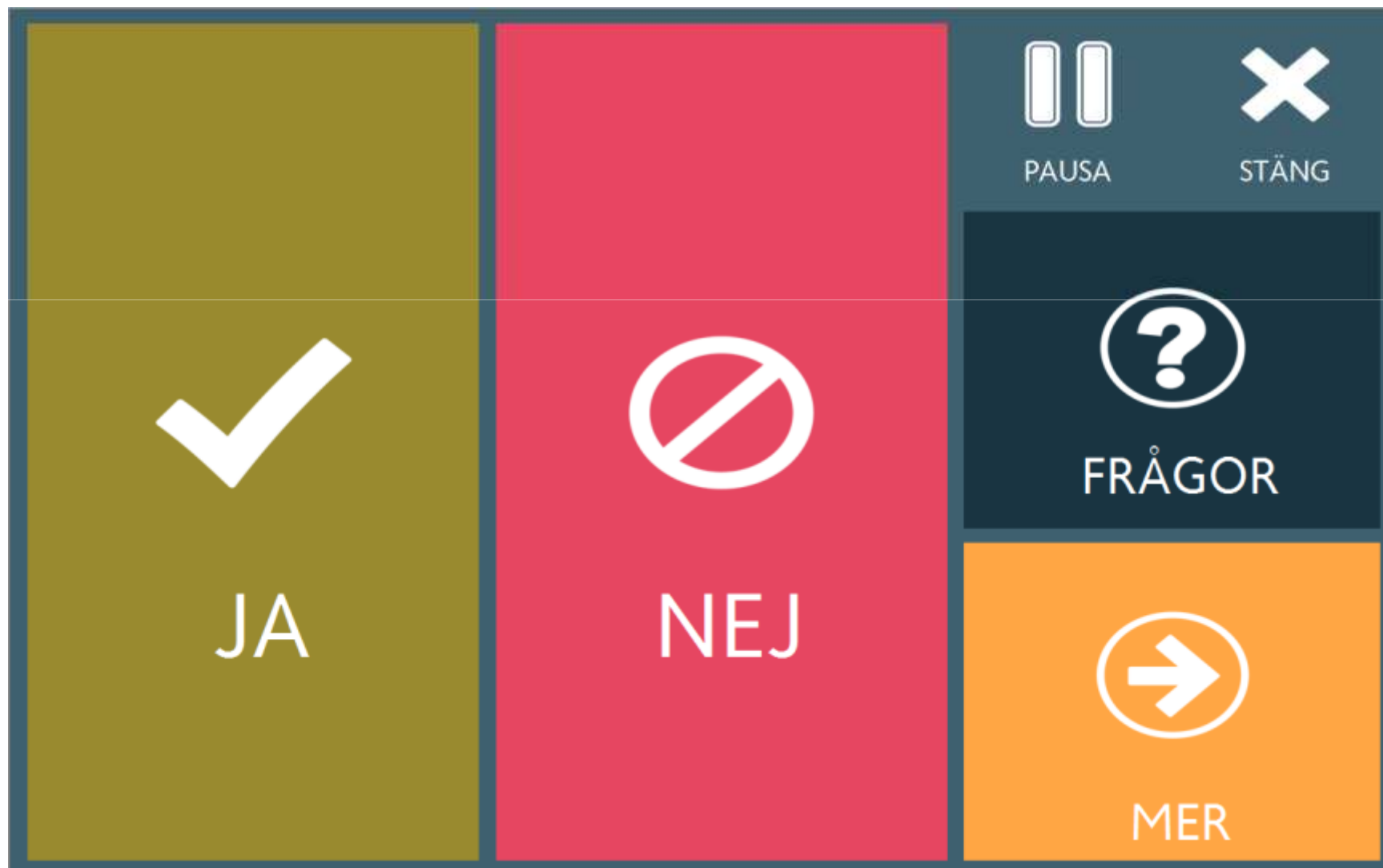


I-Series on a floor stand



I-Series on a floor stand

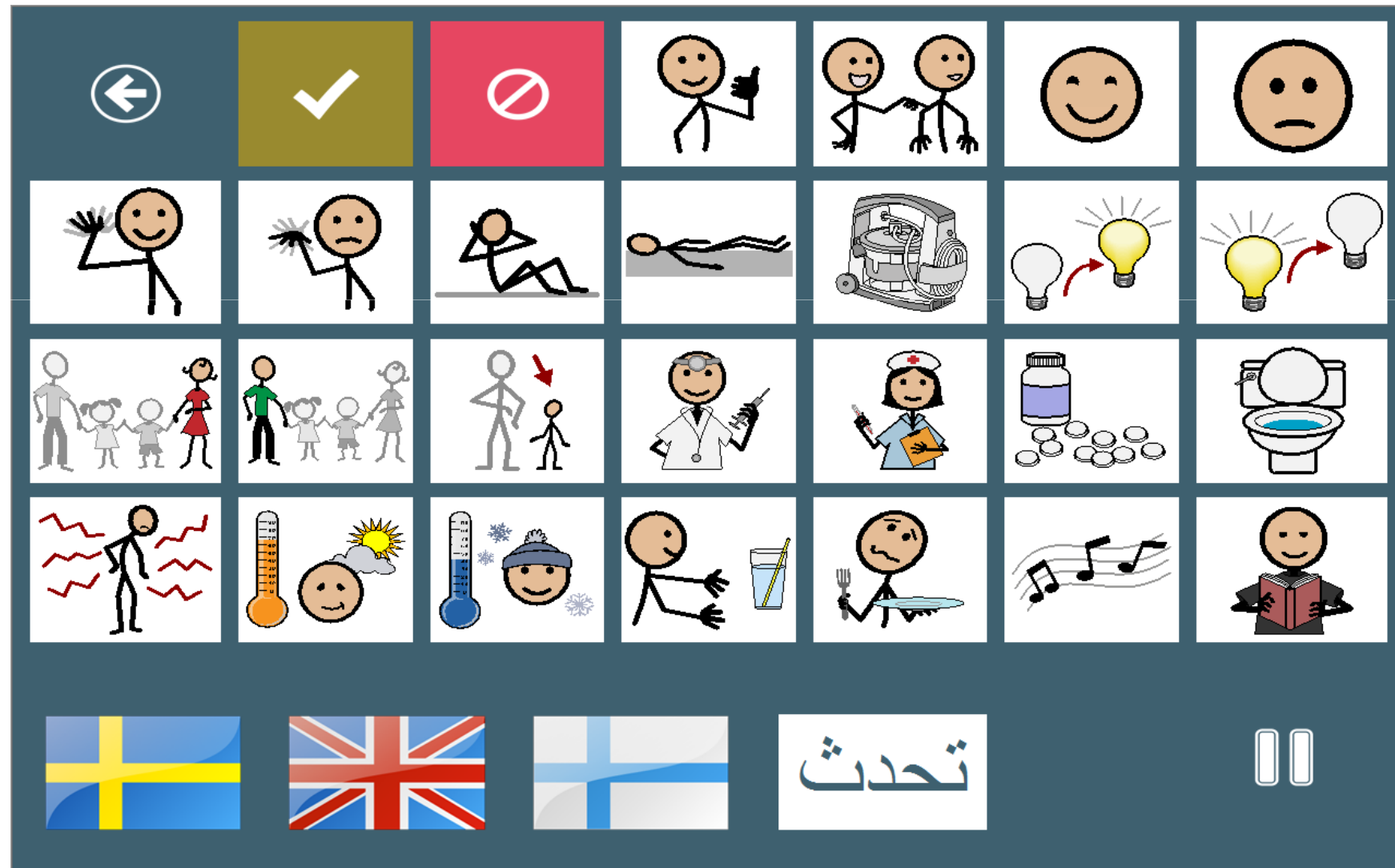
Tobii Communicator Software: Demo – ex. for ICU



Tobii Communicator Software: Demo – ex. for ICU



Tobii Communicator Software: Demo – ex. for ICU



Kaveh Vefagh

kaveh.vefagh@tobii.com